

**United Comstock Merger Mill at American Flat**  
**Environmental Assessment**  
**December 2010**

**Appendix B**  
**Structural Restoration Evaluation/Estimate**

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## **Introduction**

Reinforced concrete structures rely on the strength of concrete and steel to resist loads imposed upon them. These two components act together as a system to create strong and safe buildings capable of withstanding decades of hard use when they are adequately protected from the corrosive effects of wind and water. The American Flat Mill (AFM) buildings have been abandoned for many years; as a result they have been subjected to the deleterious effects of the elements as well as removal of critical bracing and protective roofing materials. Conditions at the site have been previously noted in Section 1.2.2.

Preservation of the AFM complex as historical artifacts will be a challenge. Both industrial and utilitarian in nature, several of these structures are unique-essentially “one-of-a-kind” from a design standpoint. Although they were built in an era when material quality control was not as stringent as it is today, many structures from this period are still performing and are capable of continuing to do so well into the future.

If these structures are to be restored and preserved, resolution of the following conditions will be required:

- Testing and modeling is required to evaluate the strength of existing components;
- Members removed or damaged during demolition of steel and roof materials must be replaced;
- Redesign and replacement of failed connections as well as adequate shoring to support the framework during reconstruction is required;
- Seismic issues will be difficult to address since the reinforced concrete column to beam/floor slab connections are already in place;
- New reinforcing must be shop fabricated from approved shop drawings and shipped to the site;
- New concrete must be shipped to the site and cast in place, requiring wood and or steel formwork;
- Adequate load capacity to allow public access will require removal and/or replacement of sections of existing slabs, columns and support foundations;
- The buildings are not code compliant-handicap access issues are significant;
- A competent contractor familiar with reinforced concrete construction and access to skilled workmen and equipment is essential; and
- The site is in a remote location.

Presuming the foregoing conditions can be overcome, the cost to complete the restorations will be substantial. The estimates assume that the buildings can be stabilized to the degree necessary to accommodate limited human entry and use for Bureau of Land Management (BLM) approved recreational activities, either by modification or demolition where stabilization is not economically possible. Therefore, values in this report are presented in a building by building format to allow the BLM to evaluate the feasibility of a phased approach to preserving individual structures within the complex and represent a cost per square foot basis.

### **Building 1 Ore Bin**

This building was utilized for bulk storage of raw ore. The framing system is open and consists of reinforced concrete floors, thick reinforced concrete bin walls, massive reinforced concrete support columns and rail support beams. The structure reflects its purpose as being originally capable of supporting fully loaded ore cars. Portions of rail supports have collapsed.

Construction costs presented herein are limited to cosmetic restoration only, as no live loading from rail cars or ore stockpiles will occur in the future. Spalled concrete decking requires sandblasting, replacement of temperature steel reinforcing and rough forming for replacement of cast in place concrete deck. Support beams exhibiting moderate spalling due to freeze thaw cycling require the removal of loose concrete, replacement of tension or compression steel, and rough forming of cast in place concrete to restore beam capacity. Collapsed supports will be demolished.

Condition: Poor

Restoration Cost: \$536,000

### **Building 2 Coarse Crushing Plant**

This building was utilized for crushing raw ore. It is a reinforced concrete structure with two basement levels as well as an extensive tunnel system below grade. The eastern end of the building is a 50' x 50' ore distribution tower consisting of basement, first and second floor slabs with a full coverage roof slab. The exterior walls are cast in place concrete with large openings on each elevation for windows which are no longer present. This portion of the structure exhibits moderate concrete spalling, most notably at the perimeter of the roof slab and wall openings. The western portion of the building is approximately 140' in length and varies from 50 to 36' in width. This elongated ore process bay consists of a basement and first floor slab with reinforced concrete crane runway support beams extending along each sidewall of the process bay. The roof beams, purlins, and panels are no longer present.

Restoration of this structure will require sandblasting and removal of loose concrete at the beams, columns, floor, and roof slab areas. Temporary shoring will be required to support critical components of the framing system during the replacement of reinforcing steel, installation of formwork and casting of new concrete surfaces. Construction costs are limited to cosmetic restoration of roof and floor slabs, window penetrations, non-load bearing exterior walls, and infill of floor penetrations in the floor slabs to permit public viewing. The basement area is currently flooded and will be pumped out and infilled with loose soil to prevent groundwater and human intrusion. The tunnel system will be abandoned in place and sealed off to prevent public access. Note that no cost has been included for restoration of either the former machine or blacksmith shops, as they are so severely deteriorated that reconstruction costs would be prohibitive. Demolition of remaining framing is advised.

Condition: Poor

Restoration Cost: \$2,284,142

### **Building 3 Fine Grinding and Concentration Plant**

This building was utilized for crushing and washing of raw ore. The framing system is cast in place reinforced concrete, with operating floors at various levels both above and below grade. The structure displays severe deterioration of floor slab concrete and reinforcing steel; however, the perimeter concrete walls as well as support columns appear intact despite floor/roof slab conditions. Spandrel beams at the perimeter of the roof slab exhibit extensive deterioration with many areas of missing concrete and exposed reinforcing steel. The roof slab itself is severely weathered; its load carrying capacity is well below original design strength due to the deteriorated conditions observed at the underside of the slab. In fact, the entire slab is in failure mode and would be better demolished for safety reasons. A portion of the ramp utilized to transport product to the third floor operations areas has collapsed and will be demolished.

Construction costs are limited to cosmetic restoration of roof and floor slabs, roof spandrel beams, non-load bearing exterior walls and infill of floor penetrations in the ground floor slab to permit public viewing and prevent access to upper floor areas.

Condition: Poor

Restoration Cost: \$4,446,540

### **Building 4 Cyanide Plant**

This building was utilized to house the cyanide leaching process for the extraction of gold and silver from ores. The structure consists of a multi-tiered slab and gallery arrangement designed to permit gravity flow of the separation process. A reinforced concrete retaining wall extends along the north and west perimeter of the plant. Most floor slab areas feature concrete pillars designed to circulate the leaching solution which appear to be in fair condition. The slab areas themselves exhibit substantial spalled areas; now serving as protection from the elements to lower process areas. The perimeter walls which support the process floors are reinforced concrete and display varying degrees of weathering and efflorescence, most likely due to the chemical reaction of the leaching solutions and the concrete aggregate. Settlement cracking appears insignificant.

Construction costs are limited to cosmetic restoration of the various floor slab/gallery areas using sandblasting equipment and cosmetic parging to restore appearance and configuration. An allowance has been included to close openings in the floors which could pose a fall through hazard to the public. Load bearing exterior walls and retaining walls will not be restored. Areas such as leachate pits and other confined spaces will be infilled to prevent human access. The concrete tank area will be cleared of brush and any access to the interior sections of the tanks or fall through hazards will be eliminated. Considering the processes utilized in the leaching process, cyanide contaminated soils should be removed from the area and land filled elsewhere on the site. No allowance has been included for this task.

Condition: Poor

Restoration Cost: \$7,856,268

### **Building 5 Warehouse**

This building was utilized as a temporary storage facility. Originally a secure structure, it was also constructed of reinforced concrete as a single floor building. The roof structure is no longer present. The exterior walls are either 8 or 14' in height, and also appear to be cast in place concrete. The floor slab is a cast in place slab on grade with a spread foundation wall to support the slab edge at the perimeter.

Construction costs are limited to cosmetic restoration of the remaining walls including cleaning and patching of the floor slab. Cost per ft<sup>2</sup> has been adjusted to reflect the utilitarian nature of the remaining structure.

Condition: Poor

Restoration Cost: \$41,600

### **Building 6 Precipitation & Refining**

This building was utilized for extraction of gold and silver leachate from cyanide solutions as well as bullion storage. It is constructed of reinforced cast in place concrete, with a ground floor slab on grade, load bearing concrete perimeter side and end walls, and a partial second floor slab. The roof structure is no longer present. The building is virtually intact except for the missing roof and framing system. It is likely the best candidate for restoration on the site based on its present condition.

Construction costs are limited to cosmetic restoration of the remaining walls and cleaning and patching of the floor slabs. No costs have been included to restore the roof framing and exterior panels.

Condition: Fair

Restoration Cost: \$209,720

### **Building 7 Assay Office**

This building was utilized for testing and sample grinding equipment. The framing system is cast in place reinforced concrete, with a slab on grade and partial perimeter concrete walls between support columns. Columns are severely weathered with exposed reinforcing steel. Spandrel beams at perimeter of roof slab are deteriorated with extensive areas of missing concrete and bare tension (bottom) reinforcing steel. The roof slab itself although severely weathered appears intact; however its load carrying capacity is questionable due to the condition of the support columns and spandrel beams.

Construction costs are limited to cosmetic restoration of the roof and floor slabs; support beams exhibiting moderate spalling due to freeze thaw cycling require the removal of loose concrete via sandblasting, replacement of tension or compression steel as required, and rough forming of cast in place concrete to restore beam capacity. Non-load bearing exterior walls will be cleaned and parged as required to restore appearance.

Condition: Poor

Restoration Cost: \$1,666,560

**Building 8 Substation**

This building was utilized for distribution of electrical power to the plant. The framing system is virtually non-existent, with a slab on grade and partial perimeter concrete walls. Six switchgear equipment piers are remaining but severely deteriorated.

Construction costs are limited to minor cosmetic restoration-cleaning and infilling of deteriorated areas of the floor slab, repair of piers to prevent exposure of reinforcing, and leveling of the surrounding grade to permit public viewing.

Condition: Poor

Restoration Cost: \$13,600

**Estimated Total Restoration Cost**

Square footage restoration costs are based on Engineering News record (ENR) 2008 Square Foot Cost Book adjusted by 7 percent to reflect 2011 pricing. The engineer has adjusted the square foot cost based on degree of difficulty and unknown conditions.

**Total Estimated Restoration Cost:**

**US \$18,248,240.00**